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bearings of these facts on the relations of man to the apes we quote as follows : —

“ From a comparison of the skeleton of the human races, as far as made, it is quite clear that in several respects some of them have peculiarities which seem to assimilate them to the apes. These peculiarities are not, however, confined to a single race, but are distributed in different degrees through several, and it is not improbable that future studies will show a still greater variety of resemblances, and a wider distribution of them, than is now known. The increased length of the forearm, as compared with the humerus, is almost equally shared by the blacks and the recent Indians. The Indians, from the mounds of various parts of the country, as well as the inhabitants of the ancient cave dwellings of Europe, have the flattened tibia. The Indians, ancient as well as modern, in common with the Hawaiian Islanders, have the most backward position of the foramen magnum, while the Negro, on the other hand, with his lengthened forearm, has this foramen almost as central as in the white man. The small brain is not, as might at first well be supposed to be the case, found in the most degraded races alone, but in these, in common with a race which had, as already stated, risen to a semi-civilization; nor is it constantly associated with the lengthened forearm, since in the Australians this is even shorter than in the white man. From these results it seems obvious that we cannot give to the alleged resemblances between the human races and the apes their full meaning, until we have much wider comparisons than have as yet been made.”

THE POSITION OF THE CADDIS FLIES.* — This paper, containing detailed descriptions with excellent illustrations, may be regarded, as the author remarks, as the continuation of several memoirs on exotic Trichoptera published in the “Transactions” of the Entomological Society of London. Quite a number of the species are from California, one is from the White Mountains, another from Newfoundland, another from New York, while the remainder are from other parts of the world. The descriptions of genera and species are elaborated with the author’s usual care and thoroughness, and great attention is paid to the illustration of details of structure, which gives the paper a lasting value.

We are also indebted to the author for his views on the systematic position of the Trichoptera, and for a very courteous criti-

* On new Forms, etc., of Extra-European Trichopterous Insects. By Robert McLachlan. Extracted from the Linnæan Society’s Journal.—Zoology. Vol. xi. London, 1871. 8vo. pp. 43, with 3 plates.

cism of the positions taken by the reviewer as to the classification of the Neuroptera. We will first quote the opinions of this able and experienced observer, and show wherein and why we differ from his conclusions :—

“But it is necessary, first of all, just to glance at the position generally accorded to the *Neuroptera*. It has long been seen that the order as defined by Linné, is composed of most incongruous materials ; and Erichson attempted an amelioration of this condition by grafting all those families with incomplete metamorphosis upon the *Orthoptera*, still maintaining the two orders in juxtaposition. Since his time various authors have made this division, termed *pseudo-Neuroptera*, a veritable refuge for the destitute. To it have been added, from time to time, *Mallophaga*, *Thysanura*, *Thysanoptera*, and even the *Strepsiptera*, for no other reason, so far as I can see, than that they would not fit in satisfactorily elsewhere ; and the characters of the order being so elastic, it was easy to find some peculiarities which gave these outlying families admission therein. That the Linnæan families grouped now with *Orthoptera* have more affinity thereto than to the *Neuroptera* as usually constituted, is evident ; yet I see no reason whatever why the *Odonata* should not form an order apart, possessing as they do, characters absolutely *sui generis*. The admission of them into *Orthoptera* renders an already heterogeneous order an absolute chaos. For my part, I have been content to consider the *Neuroptera* as an order, in the Linnæan sense, divisible into three great divisions, *pseudo-Neuroptera*, *Planipenna*, *Trichoptera*,—but this only as matter of convenience ; for I am convinced that contained therein are constituents of several orders, each of equal value with such as *Lepidoptera*, and *Coleoptera*, and that the day will arrive when, from an increase of knowledge in embryology and anatomy, the order *Neuroptera*, as constituted by Linné, will be scattered widely—a dismemberment that would have occurred long since, only that there still exists a lingering disinclination to thoroughly upset the Linnæan system.

Dr. Packard's arrangement is founded on the idea that in insects as in all other divisions of the animal kingdom, there are certain groups more elevated, others more “degraded” than the rest. Acting upon this, he places the *Hymenoptera* as structurally and psychically, if I may use the term, superior to all other insects. Then follow *Lepidoptera*, *Diptera*, *Coleoptera*, *Hemiptera*, *Orthoptera*, and last of all, the *Neuroptera*, in the Linnæan sense (but including *Thysanura*), an order which, according to him, “mimics every suborder of insects,” being “comprehensive or synthetic types, combining the structure of all the other suborders”. I would here particularly call attention to the relative positions occupied by *Lepidoptera* and *Trichoptera*, the latter forming nearly the last division of *Neuroptera*. I emphatically enter

my protest against such a wide separation of the two groups, considering, as I do, that, whatever may be the condition of the *Trichoptera* with regard to others of the Linnæan groups of *Neuroptera*, their relationship to the *Lepidoptera* is close, and that an attempt to thus widely separate them is an outrage on both. In metamorphosis the resemblance is nearly complete, the fact of the pupal limbs not being enclosed within a common integument not availing much when their condition in certain *Microlepidoptera* is taken into consideration: the possession of mandibles by the Trichopterous nymph is not of much importance, insomuch as these organs bear no relationship to the aborted mandibles of the imago; they simply replace the acid or mechanical means by which a Lepidopterous imago frees itself from its cocoon. The imago in *Lepidoptera* is almost constantly furnished with scales on the wings and body, scales of a peculiar nature, the analogues of which are seen only in *Lepisma*; but many Trichopterous insects have, in the male, a modification of these scales in the form of short inflated hairs, generally intermingled with ordinary hairs; and in some genera this tendency towards a scaly clothing is as marked as its absence in some *Lepidoptera*. The neural arrangement is not at all incompatible with a close relationship; nor are the parts of the mouth, excepting the absence of a developed haustellum; yet many of the larger *Trichoptera* frequent flowers for the purpose of extracting the nectar; and though I am unable to say by what means this is effected, it seems probable that it is done by prolongation, at will, of the upper portion of the œsophagus into a sort of false haustellum. Perhaps the strongest mark of demarcation is the presence, in most Lepidopterous imagos, of a spine-like process near the base of the costa of the hind wings, wanting in all *Trichoptera*. That this process is a modification of a vein is almost certain; and I apprehend that, when the homologies of neururation are better understood, this negative character in *Trichoptera* will not be found of much importance. My own inclination tends strongly towards maintaining *Trichoptera* as a separate order in juxtaposition with *Lepidoptera*."

First: we fully agree with the author that the admission of the Odonata (*Libellulidæ*) into the Orthoptera "renders an already heterogeneous order an absolute chaos." But on the other hand, we think the burden of proof that the "Odonata" are not true Neuroptera rests on those who regard the group as an independent order. Where respectable authorities (taking it for granted that their characters are neither Neuropterous nor Orthopterous, which we do not admit), regard them as a division of Neuroptera, no one having, as far as we know, considered them as Orthoptera before Erichson's time; and others equally respectable regard them as

Orthopterous, or Pseudoneuropterous, we would abide by embryological data to decide the question. The embryology of the Libellulidæ is perhaps as thoroughly known as that of any other group of insects. During the past summer the writer has observed with considerable care the embryology of *Chrysopa*, a type of the "true" Neuroptera, in the restricted sense. In the earliest and later stages the development of this genus is almost identical with that of the dragon flies, as regards the structure and relations of the "amnion" and "visceral membrane," the relations of the primitive band, the early form of the embryo, and its position just previous to exclusion from the egg (see this journal, p. 564). The differences are merely such as we would expect to find between two families of the same order. Thus embryology gives us the most unexpected and independent testimony as to the close alliance at least of the Libellulidæ and Hemerobidæ. Should our conclusions stand the test of the observations and criticisms of abler naturalists, then have we not demonstrated the close relationship of these two divisions of (what we regard as) Neuroptera? We conceive the greatest gap in the Neuroptera (in the Linnæan sense) to be between these two families. The Libellulidæ, through the Ephemeridæ, their nearest allies, pass into the Perlidæ and Psocidæ; on the other hand, the Hemerobidæ are connected by many characters with the Panorpidæ, and to the latter, as we believe, the Phryganeidæ (Trichoptera) are more nearly related than any other group of insects, whether we take into consideration the structure of the adults, or the form of the larva and pupa, and their metamorphoses. The gap between the Libellulidæ and Hemerobidæ is indeed a wide one, but have we not seen that the foundations of the bridge have been laid in the embryonic stages, and may we not feel authorized in view of recent discoveries of paleozoic net-veined insects, in believing that the superstructure, the arches and timbers of the bridge, has been swept away by the storms and floods of past geologic ages? Evidence is accumulating and growing stronger each year, if we interpret the facts aright, that the gaps between what we consider the families of the Neuroptera are due to the extinction of genera and species in paleozoic and mesozoic times. So that instead of a "dismemberment" of the Neuroptera, we shall really have a more thoroughly compacted and natural group than as yet recognized by systematists.

Secondly, as to the relationship of the Trichoptera to the Lepidoptera. It seems to us that we each look upon this matter from a different standpoint. We would claim that the characters which Mr. McLachlan relies upon as allying the caddis flies to the moths are adaptive and of secondary importance. Let us leave them out of sight for the moment, and look at what the reviewer deems the more essential ones. Strip our examples of moths and caddis flies of their wings and legs up to the coxæ, removing the antennæ and palpi, and place the naked trunks side by side. We shall find a wonderful uniformity of structure in the head and body of the Lepidoptera, to which we have previously called attention.* We shall observe that the three portions of the lepidopterous head, the occiput, epicranium, and clypeus, always preserve much the same relation to each other. The front of the head is formed by the epicranium and clypeus, the latter usually being the larger of the two parts, though in the Tineids the two pieces are of nearly the same size. Looking at the thorax, another essential character of the Lepidoptera is the very short metathorax, and the absence of the præscutum. In one moth, the degraded Hepialus, the metathorax is much longer than in any other moth known to us, and the præscutum is well developed,† resembling the “true” Neuroptera in this respect. The head of the Phryganeidæ, though varying greatly in the different genera, differs invariably from that of the moths in the front of the head consisting of the clypeus alone enclosed in the broad orbits, while the broad vertex consists of the epicranium, which is as large as the entire front of the head; the head is wider and the eyes much smaller than in the moths; and another important character is the broad, deeply excavated front edge of the clypeus, this part in the moths being invariably narrower and much rounded.‡

The metathorax of the caddis flies is always much longer than in the moths, often twice as long, and the præscutum is nearly always well developed. These characters of the head and thorax

*Notes on the family Zygaenidæ. Proc. Essex Institute. IV. 1864. p.14.

†For further remarks and figures in illustration see our remarks “On Synthetic Types in Insects.” Journal of the Boston Society of Natural History. viii. 1863.

‡These remarks are based on careful observations of *Hallesus* sp. *Limnophilus despectus*, *Philopotamus* sp., and *Setodes exquisita*. From an examination of these portions of the body in these and other genera we would inquire whether neuropterists have not overlooked the source of most excellent and stable generic characters; those most in use, such as the venation and spurs varying in different sexes of the same species.

noticed in the caddis flies are just those characterizing the Neuroptera. If we place our trunk of a caddis fly by the side of that of any one of the Hemerobidæ we shall find a much greater similarity to this family than the moths. So far as we are aware neuropterists have never paid sufficient attention to the parts of the trunk to which we have referred, just as lepidopterists have uniformly overlooked the characters noticed above, and which are of the first importance in establishing families.*

As to the less essential characters, called secondary or adaptive by naturalists, we have gone as far as any one† in noticing their remarkable analogy to those of the Lepidoptera. But we should not feel authorized on this account to remove the caddis flies from the Neuroptera, and place them in an independent group next to the Lepidoptera. On the same principle we might remove the Psocidæ and place them in an independent order next the Aphidæ; or remove the tailed Batrachians and place them among the lizards.

Turning to the larvæ, we find that their most essential characters ally them to the aquatic Hemerobidæ and Sialidæ, the larvæ of some genera closely resembling in their essential characters that of *Corydalus*; in the pupa, the limbs are as free as in those of the two neuropterous families Hemerobidæ and Sialidæ. While in the majority of lepidopterous pupæ the limbs are soldered to the body, yet where they are partially free, as in some *Tineidæ*, the form of the lepidopterous pupa is throughout adhered to more strictly than would be inferred from Mr. McLachlan's statement.

Our author says that the mandibles of the pupa "bear no relationship to the aborted mandibles of the imago." May we ask with what organs he homologizes the mandibles of the Phryganeid pupa, if not with those of the larva and adult?

Taking up the points of resemblance to the Lepidoptera, brought forward by our author, we would agree with him that they are for the most part very remarkable and suggestive, but would suggest that they are not of much value when used as ordinal characters. He does not seem to notice the fact that insects of other groups than the Lepidoptera and Trichoptera have scales on their bodies. We would go farther than him and say that the scales of *Lepisma* and we would add of all the *Thysanura* (except in a few scaleless genera) are truly homologous, rather than "analogous" with those

* See remarks in "Notes on the family *Zygænidæ*."

† Synthetic Types, etc.

of the Lepidoptera. Certain Diptera, such as the Culicidæ, have scales mingled with the hairs on their bodies, as many years ago shown by Mr. Jabez Hogg, and more recently by Müller; the species of *Amphientomum* of the family Psocidæ, as he is undoubtedly well aware, have scaly bodies; so that this character is by no means peculiar to the two groups mentioned by our author. Did the Trichoptera possess the hook and bristle in the wings of the Lepidoptera (a most inconstant character even in the moths) why should such a trivial character be considered as of any importance in ranking ordinal (or subordinal) groups?

Our own view, judging not only from the structure of the adults, but also of the larvæ and pupæ, is that the Lepidoptera rank next above the Diptera, the Tineids and Pterophoridae having many points of agreement with the Culicidæ and Tipulidæ, which seem to us to be as deeply seated as the resemblance to the Phryganidæ. In an evolutionary point of view we have been accustomed to regard the moths as having perhaps sprung from these dipterous families. Hence we have been unable to agree with the opinion of E. Müller (see this journal, vol. v, p. 288) that the Lepidoptera have sprung from the Phryganids, though we can easily see that many will be convinced by his statements. But he has, we venture to think, erred in the same way as our author, in overlooking the fundamental characters of the Phryganidæ, and regarding the adaptive, superficial characters, drawn mostly from the appendages, as of primary value.

SUPPLEMENT TO THE CATALOGUE OF OPHIURIDÆ OF THE CAMBRIDGE MUSEUM.*—This paper is particularly interesting from the excellent figures illustrating the most important species dredged at great depths between Cuba and the Florida Reef. The note on nomenclature and classification deserves mention in connection with the article on this subject by Mr. Alex. Agassiz, published on p. 354 of the present volume of this journal. As to the matter of changing the *authority* with each change in the *combination* of the name of a genus and species, Gen. Lyman opposes the view of Dr. Lütken, the distinguished zoologist of Copenhagen in the following terse language:—

“For instance, we have, in 1854, *Ophiura nodosa* Ltk. I after-

* Illustrated Catalogue of the Museum of Comparative Zoology, at Harvard College. No vi. Supplement to the Ophiuridæ and Astrophytidæ. By Theodore Lyman. Cambridge, 1871. Royal 8vo. pp. 18. With 2 plates.